Package 'ARMALSTM'

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Type Package

Title Fitting of Hybrid ARMA-LSTM Models

Description The real-life time series data are hardly pure linear or nonlinear. Merging a linear time series model like the autoregressive moving average (ARMA) model with a nonlinear neural network model such as the Long Short-Term Memory (LSTM) model can be used as a hybrid model for more accurate modeling purposes. Both the autoregressive integrated moving average (ARIMA) and autoregressive fractionally integrated moving average (ARFIMA) models can be implemented. Details can be found in Box et al. (2015, ISBN: 978-1-118-67502-1) and Hochreiter and Schmidhuber (1997) <doi:10.1162/neco.1997.9.8.1735>.

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Imports rugarch, tseries, tensorflow, keras, reticulate

NeedsCompilation no

RoxygenNote 7.3.1

Repository CRAN

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Contents

ARMA.LSTM	*Hybrid ARMA-LSTM Model for Time Series Forecasting*

Description

The linear ARMA model is fitted to the time series. The significant number of PACF values of ARMA residuals are considered as the lag. The LSTM model is fitted to the ARMA residuals setting the lag value as the time step. User needs to install keras, tensorflow and reticulate packages as the prerequisite to implement this package.

Usage

```
ARMA.LSTM(X, p, q, arfima = FALSE, dist.model= "ged", out.sample, LSTM.units,
ACTIVATION.function = "tanh", DROPOUT = 0.2, Optimizer ="adam", Epochs = 100,
LSTM.loss = "mse", LSTM.metrics = "mae")
```

Arguments

X	A univariate time series data
p	Order of AR
q	Order of MA
arfima	Whether to include arfima ($0<d<0.5$)
dist.model	The distribution density to use for the innovation. The default distribution for the mean model used is "ged". Other choices can be obtained from the rugarch package.
out.sample	A positive integer indicating the number of periods before the last to keep for out of sample forecasting. To be considered as test data.
LSTM.units	Number of units in the LSTM layer
ACTIVATION.function	
	Activation function
DROPOUT	Dropout rate
Optimizer	Optimizer used for optimization of the LSTM model
Epochs	Number of epochs of the LSTM model
LSTM.loss	Loss function
LSTM.metrics	Metrics

Value

- ARMA.fit: Parameters of the fitted ARMA model
- ARMA.fitted: Fitted values of the ARMA model
- ARMA.residual: Residual values of the ARMA model
- ARMA.forecast: Forecast values obtained from the ARMA model for the test data

- ARMA.residual.nonlinearity.test: BDS test results for the ARMA residuals
- LSTM.lag: Lag used for the LSTM model
- FINAL.fitted: Fitted values of the hybrid ARMA-LSTM model
- FINAL.residual: Residual values of the hybrid ARMA-LSTM model
- FINAL.forecast: Forecast values obtained from the hybrid ARMA-LSTM model for the test data
- ACCURACY.MATRIX: RMSE, MAE and MAPE of the train and test data

References

- Box, G. E., Jenkins, G. M., Reinsel, G. C., & Ljung, G. M. (2015). Time series analysis: forecasting and control. John Wiley & Sons.
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- Rakshit, D., Roy, A., Atta, K., Adhikary, S., & Vishwanath. (2022). Modeling Temporal Variation of Particulate Matter Concentration at Three Different Locations of Delhi. International Journal of Environment and Climate Change, 12(11), 1831-1839.

Examples

```
y<-c(5,9,1,6,4,9,7,3,5,6,1,8,6,7,3,8,6,4,7,5)
my.hybrid<-ARMA.LSTM(y, p=1, q=0, arfima=FALSE, dist.model = "ged",
out.sample=10, LSTM.units=50, ACTIVATION.function = "tanh",
DROPOUT = 0.2, Optimizer ="adam", Epochs = 10, LSTM.loss = "mse", LSTM.metrics = "mae")
```

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